ANNUAL PROGRESS REPORT
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Title: Multi-Scale Atmospheric Numerical Modeling and Data
                   Assimilation for Planetary Applications - with a Focus on Mars
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The work plan for year 2 of the proposal was as follows:

Year 2:

Complete planetary generalization, validate for Mars, and release (Ewald, Graduate Students, Richardson, Toigo): we will add Mars-"physics" and appropriate physical constants to the generalized model and test the planetary WRF system as a mesoscale and microscale model, results will be compared against the Mars MM5 model [Toigo and Richardson, 2002; Toigo *et al*., 2003] and published results from other Mars mesoscale models [Rafkin *et al*., 2001; Tyler *et al*., 2002], following validation, the generalized code will be returned to NCAR with complete documentation and potentially (depending on whether NCAR includes the code in the release-version of WRF) will be made available from a public Caltech website.

Continue GCM modifications (Toigo, Richardson): implement polar boundary conditions for the northern and southern domain edges

Begin polar-stereographic global WRF (Ewald, Toigo, Richardson): a boundary condition option allowing two non-overlapping domains to be run interactively will be developed following Dudhia and Bresch [2002], with the goal of developing global coverage with two polar-centered, polar-stereographic domains.

Part 1 (generalization and validation) has been completed. The code now has been proven to work for Mars and for Titan, and is currently being adapted for use on Venus. The Mars model has been tested in global, mesoscale, and LES modes. Discussions with NCAR have will to the global version of WRF becoming part of the general NCAR release version in the next year. The generalized planetary code will not be supported by NCAR. Instead, we have acquired the rights to www.planetWRF.com, which will become the home for dissemination of the planetary version (and documentation).

Part 2 (GCM modifications) were completed in year 1.

Part 3 (polar stereographic WRF) will not be undertaken. Instead (and in discussion with NCAR), we decided to implement a "rotated pole" version of the model that allows the computational and geographical poles to be located in different locations on the globe. In this way, the pole can become a high-quality region within the computational domain, with higher-resolution nesting over the poles possible. This provides a better and more direct approach to the goal of developing high-quality simulations of the poles.

Untasked: we have completed the modifications necessary to allow WRF to run as a 1D (column model) for in-place testing of "physics" routines.

Years 3 tasks.

Year 3 was originally slated to complete the seamed polar stereographic capability. However, this will not be pursued. The one area of model development that is substantially behind-hand is nesting (one-way and dynamic). We are working with NCAR to understand the problems and find a solution in Year 3 (without nesting, a major advantage of WRF is removed). Nesting is fully functional in the terrestrial version of the model, so this problem should be soluble.

In addition, we will complete papers describing the model, and bring the www.planetWRF.com website online.